Case note
ABB generators and converters help AREVA wind turbines optimize energy yield at alpha ventus

alpha ventus, also known as Borkum West I, Germany's first offshore wind farm (source: AREVA Wind, Jan Oelker)

alpha ventus, Germany's first offshore wind farm, came online in April 2010.

The six, 5 megawatt (MW) AREVA M5000 wind turbines are equipped with ABB generator-converter packages.

During the first three years of operation, the power generated by alpha ventus was approximately 10 percent higher than estimated.

alpha ventus

alpha ventus, Germany's first offshore wind farm, is located in the North Sea, 45 kilometers (km) north of the island of Borkum. Officially commissioned in April 2010, it has a rated output of 60 megawatt (MW).

The wind farm, which is owned and operated by DOTI (Deutsche Offshore-Testfeld und Infrastruktur GmbH & Co. KG), a consortium of utilities EWE, E.ON and Vattenfall, consists of 12 turbines of which six are 5 MW AREVA M5000-116.

Electrical drivetrains

The centerpiece of a wind turbine is the electrical drivetrain – the generator-converter package – which converts the captured wind energy into electric power and feeds it into the grid.

ABB supplied the generator-converter packages for the AREVA M5000 wind turbines. The electrical drivetrain uses medium-voltage (3300 volts (V)), which, according to Wilhelm Jansen, Head of the E-Power department at AREVA Wind, is an advantage over the design used by some other off-shore wind turbine manufacturers. One of the advantages is: "Medium voltage drivetrains have lower currents, reducing the electrical losses and increasing the turbine's efficiency."

ABB's medium speed permanent magnet generator is designed for optimum offshore performance.

The PCS6000 medium voltage wind turbine converter is installed in a face-to-face configuration in the tower of the turbine.

Generators

The M5000 has a hybrid, fully integrated generator-gear system operating at medium speed. It uses ABB's high-efficiency permanent magnet (PM) generator which is designed for optimum offshore performance. As PM generators have nearly no excitation losses they are extremely efficient, especially at partial loads with low wind.

The compact design of the hybrid system results in significantly lower maintenance and higher reliability, compared to an equivalent 5 MW direct drive machine.

MV full power converters

The generator is connected to the grid via the PCS6000 medium voltage full power converter. The 4-quadrant converter allows maximum speed variability and provides optimal active and reactive power to ensure grid code compliance. Its voltage ride-through capabilities keep the turbine online even during grid faults.

As a medium voltage solution, it uses lower currents than low voltage solutions. This reduces losses in the electrical drivetrain, which therefore increases the turbine's power output.

Cooperation for success

To maximize the electrical drivetrain benefits, AREVA Wind and ABB worked closely together throughout the entire wind turbine development – a cooperation that paid off.

Annual yield exceeds project forecast

According to DOTI, the power generated by alpha ventus during the first three years of operation, was approximately 10 percent higher than estimated. During 2011 to 2013, alpha ventus fed some 253 gigawatt hours (GWh) per annum into the grid, sufficient to supply approximately 72,000 households.

A bright and windy future

By the end of 2014, AREVA Wind will have installed a further 120 of the AREVA M5000 turbines at two North Sea wind farms – Trianel Windpark Borkum and Global Tech I – each using ABB PM generators and full power medium voltage converters, built specifically for offshore wind production.

For more information please visit:

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